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Electrodynamics of a Cosmic Dark Fluid

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Abstract

© 2016 by the authors.Cosmic Dark Fluid is considered as a non-stationary medium, in which electromagnetic waves propagate, and magneto-electric field structures emerge and evolve. A medium-type representation of the Dark Fluid allows us to involve in its analysis the concepts and mathematical formalism elaborated in the framework of classical covariant electrodynamics of continua, and to distinguish dark analogs of well-known medium-effects, such as optical activity, pyro-electricity, piezo-magnetism, electro- and magneto-striction and dynamo-optical activity. The Dark Fluid is assumed to be formed by a duet of a Dark Matter (a pseudoscalar axionic constituent) and Dark Energy (a scalar element); respectively, we distinguish electrodynamic effects induced by these two constituents of the Dark Fluid. The review contains discussions of 10 models, which describe electrodynamic effects induced by Dark Matter and/or Dark Energy. The models are accompanied by examples of exact solutions to the master equations, correspondingly extended; applications are considered for cosmology and space-times with spherical and pp-wave symmetries. In these applications we focused the attention on three main electromagnetic phenomena induced by the Dark Fluid: first, emergence of Longitudinal Magneto-Electric Clusters; second, generation of anomalous electromagnetic responses; third, formation of Dark Epochs in the Universe history.

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Keywords

Axion electrodynamics, Dark energy, Dark matter